

OCR Computer Science A Level

1.5.2 Moral and Ethical Issues

Advanced Notes



Specification:

1.5.2

- **Moral, social, ethical and cultural opportunities and risks of digital technology:**
 - Computers in the workforce.
 - Automated decision making.
 - Artificial intelligence.
 - Environmental effects.
 - Censorship and the Internet.
 - Monitor behaviour.
 - Analyse personal information.
 - Piracy and offensive communications.
 - Layout, colour paradigms and character sets.



Morals and Ethics

Ethics are concerned with our **values as a community** and how these will **impact different groups of people** in society. **Morals** are to do with our **personal code of conduct** and encompass **how we choose to behave**, including the **decisions we make** at the expense of others.

With computers becoming an integral part of almost **every aspect of our day-to-day lives**, it is important that we consider the **moral, ethical, environmental, social and cultural implications** of these changes. Identifying these issues is the first step to resolving them.

Computers in the Workforce

Over the past decade, there has been growing speculation about how computers will impact the world economy, in particular our jobs. Currently, almost all businesses depend on computers to perform certain functions but there is growing uncertainty as to the effects of a completely computerised society and the likelihood of this.

There are many advantages to involving computers in the workforce, which is why they are key to modern businesses. First, they **improve efficiency**. For companies such as Amazon and Effidience, machines have successfully been used to **reduce delivery times** and **speed up manufacturing processes**, thus **improving customer satisfaction** and reducing **unit labour costs** which feed through as **lower prices for consumers**. While Amazon uses robots in their warehouses to package and transfer goods between stations, Effidience's PostBot is able to navigate through neighbourhoods to deliver letters and parcels from door-to-door. Another advantage of these computerised roles is that they **reduce strain on workers** and reduce the need to work in a **repetitive and tedious environment**.

On the other hand, this has resulted in a number of people losing their jobs, creating high levels of **structural unemployment**. The effects of this may not necessarily be long-term as it is likely that higher consumer demand due to cheaper services will **create employment in other sections of the business**. For the effects to be made less severe, governments must invest in providing **retraining programmes** so people are able to change occupation. The question is whether this is enough to counteract the effects of computerisation.

Computerisation has hit middle-income manufacturing jobs the hardest, where entire production lines within factories have been replaced by robots. As such, there has been a **shift toward low-income service jobs**. More recently, computers have been used to replace workers in occupations other than manufacturing, including library assistants and taxi drivers. This suggests more jobs are at risk than the repetitive jobs commonly associated



with automation. One of the major downsides to a significantly computerised workplace is a **high dependence** on them; if something goes wrong, there will be a major loss of output.

With increased computerisation, **demand for people in computing-related occupations** has increased, as would be expected. Software developers are needed to produce working programs for embedded systems within smart devices and network engineers are required to maintain extensive networks within schools, for example. As a result of computers generally becoming an essential part of the workplace, employers are now looking for workers who are able to **confidently and productively use computers**.

With the Internet becoming accessible to almost everyone, there has been a rise in the **services being offered exclusively online**. Examples of this include online shopping and online banking services. This has **reduced costs of renting** out a physical space whilst simultaneously **cutting labour costs** as fewer workers are required to work as front-facing retail staff and bank clerks. Meanwhile, demand for delivery drivers to ship parcels and web developers to ensure the website is consistently functioning has grown.

Automated Decision Making

In the modern world, it has become increasingly common for decisions to be made by algorithms. Often these decisions have the potential to significantly affect people's lives and so the ethics of automated decision making is much debated.

Automated decision making is used to determine what different users should be displayed on their **social media feeds**. This may be based on **users' interactions** and **inferences about their interests** based on their connections, for example. Is it important that users are shown important news stories or should their feed be tailored to their interests? The fear is that solely reinforcing people's interests creates a **dangerous bubble** in which their beliefs are never challenged, leading to a **close-minded society**.

In the US, algorithms have been used in the past to assess a criminal's likelihood of committing another crime based on a number of factors. Algorithmic decision-making has also been used in **various application processes** to determine a person's suitability for mortgages, loans, and jobs. Relying entirely on these algorithms could result in people being **treated unfairly**, as these algorithms do not consider extenuating circumstances and are unable to process information with the same **consideration of contextual factors** that humans are able to provide.

There is no doubt, however, that these algorithms have **improved productivity** and made certain application processes **more convenient** for employers. Companies are able to **hire workers faster** using algorithms which can screen candidates for certain desired qualities



before the interview stage, for example. In driverless cars, the use of algorithmic decision making often means decisions are made faster than humans are capable of reacting, so have the potential to save lives.

Automated decision-making has almost taken over [trading](#) on the stock market, as it allows traders to look at past trends to [model future changes](#). This sort of fast decision-making is also useful in [plant automation systems](#) and [power distribution systems](#) as various inputs can be collected and analysed to [respond instantly to changes](#), such as increasing the power supply when demand is forecast to rise, for example.

Ultimately, algorithms must be [thoroughly tested](#) to produce a high-quality piece of software, [free of bias](#) against any group of people. To perform well, they must be provided with factually correct data. It is also important to recognise that algorithms have been designed by a group of software developers so cannot be assumed to be free of bias. As such, it is key that algorithms do not remain a black box; the decisions made must be justified and some level of human input is essential to ensure fairness.

Algorithmic decision-making in driverless cars raises ethical questions about how to decide [who should be harmed](#) if a scenario arises in which either a pedestrian or the driver must be harmed. This then raises questions about [who is responsible](#) for the consequences of this decision.

Artificial Intelligence

Artificial intelligence is the ability of a computer to [replicate human intelligence](#), [cognitive ability](#), and [grasp abstract concepts](#). AI is playing a key role in furthering research in medicine, where it is used in expert systems to draw [connections between illnesses to form diagnoses](#).

[Expert systems](#), also known as [knowledge-based systems](#), replicate the knowledge and experience an expert in a particular subject would have. They are made up of a [knowledge base](#) which consists of a [set of facts and rules](#) which are used to build an [inference engine](#). This is interrogated to find diagnoses.

One of the most common uses of AI is [neural networks](#) which replicate [biological neural networks](#). These 'learn' from a set of data that they are given and this knowledge can be [applied to new data sets](#), in the same way a human is able to. This is used in [pattern detection](#) and picking up on [financial fraud](#).



AI is seen within [voice recognition systems](#) which are now common within [smart home systems](#) such as Google Home and Amazon's Alexa. These have increased convenience for people but raise questions about [privacy](#), as they are required to be constantly switched on to function.

Again, artificial intelligence raises questions about [accountability](#): who is responsible when things go wrong? If AI ever reaches a stage at which it is considered sentient, what rights should it have?

Environmental Effects

With technological devices being produced cheaply and widely, they have become affordable for a large proportion of the world population. The downside to this is the effect on the environment. The pressure of keeping up with trends coupled with the affordability means that people now throw away more devices than before. Some computer components are built of [mercury](#) and [radioactive isotopes](#) which are [toxic](#) and can [contaminate water supplies](#). Often, this [e-waste](#) is shipped to [third world countries with lower environmental standards](#) to be disposed which is considered to be immoral and unacceptable.

With more devices around and processes becoming partially or entirely computerised, [more electricity is required](#) to power these devices. This requires using up our store of [non-renewable fossil fuels](#) which [emit greenhouse gases](#) into the atmosphere, contributing to [global warming](#). The rate of climate change has accelerated over the past year, indicating that we need to be more careful about our consumption and cut down the [throw-away attitude](#) when it comes to technological devices. The effects on the planet as a result of our consumption will go on to [impact future generations](#) as well as [biodiversity](#).

Despite this, there has been a push in the UK for [renewable energy](#) which counteracts the effects of increased electricity consumption to an extent. Alongside new technologies, there has been a growth in [environmentally-friendly technologies](#). Examples of this include [smart home systems](#) which use temperature sensors to determine when heating should be switched on and motion sensors to switch off lights when a room is empty. Personal computers and laptops offer 'Sleep' and 'Stand-by' features and some newly developed car engines are designed to prevent them from idling so reducing emissions. This suggests technology has the potential to offset some of the effects on the environment.



Censorship and the Internet

Censorship is the act of **suppressing the content that people are able to view, publish and access**. Some countries use censorship to **block out other political opinions**. There is much debate about the extent to which government should be able to **control what we have access to** and decide what is best for the public.

In the UK, ISPs block websites with content associated with **terrorism and extremist political beliefs**. There is fear that censorship may be used to **block out alternative political beliefs**. At this point, censorship would not be acting to protect the country but rather to **push a certain ideology**, which some people consider to be unethical and unacceptable.

ISP

Internet Service Providers, supply Internet to households and companies.

Many people believe in the idea of a '**Free Internet**', where **nothing is filtered at all**, in line with the principle of freedom of speech. Indeed, Tim Berners-Lee created the internet to be a space where people could share and **mutually benefit from resources**. However most people agree that some extent of censorship has become necessary for **national security purposes** and to **filter offensive comments and extremist propaganda**.

Censorship can also exist on a smaller level, such as within a school in which pupils may be prevented from accessing material deemed to be unsuitable. Within the workplace, censorship may be used to **maintain high productivity and prevent distractions**.

Monitor Behaviour

Computers are used to monitor people's behaviour in various environments. In many workplaces, **employers monitor productivity** by tracking the websites and applications workers are accessing and the time spent on these.

Surveillance systems and in particular, CCTV cameras are widely used for **security purposes** and to **detect crime**, from speeding to violence. This is useful for tracing and punishing criminal activity. Ankle monitors are another kind of surveillance device used on people under house arrest to track their location. While some people argue that this is unethical and contravenes basic human rights, others argue that this is a necessary measure that must be taken to put people off committing crime.



Analyse Personal Information

Companies have recently become aware of the value of data, which can **reveal key insights about people and their behaviours**. Large amounts of data from a number of **sources**, called **big data**, can be **analysed to make inferences** about people's behaviour, likes and dislikes, for example. This process is called **data mining** and can be used to **inform personalised political propaganda, targeted advertising** or alternatively, to identify previously unknown connections between two variables.

There is some concern, however, that insights from personal information could reveal things that act against certain individuals. A common example is data mining uncovering that a certain individual is at high risk of developing a particular disease. With this information, an insurance company may deny them insurance or charge a higher premium. This raises ethical questions about whether companies uncovering these trends have a responsibility to feed this information back to users.

Although companies are legally required to **state what kinds of data they are collecting** from you, this may not always be obvious to users. There is pressure on large firms to be more transparent about the data they collect and making it clearer what it will be used for. The **Data Protection Act developed in 1998** is no longer sufficient when it comes to protecting public welfare which is why the **GDPR** has been enforced as of May 2018.

Synoptic Link

You will have come across Computing-related legislation such as the DPA in 1.5.1.

Piracy and Offensive Communications

Piracy is the **unauthorised copying of content**, such as software or media including music and films. This is a **form of theft and is illegal**; although the Internet has made it easier than ever before to source these types of content online, it is up to the individual to make the decision as to whether or not this is ethically correct.

While the Internet has opened up countless positive pathways for the betterment of society, it also provides a **seemingly anonymous front** for people. Offensive communication refers to any sort of **online harassment, including cyber-bullying or stalking**. The **Malicious Communications Act** introduced in 1998 makes it a **criminal offence to send indecent or offensive messages to anyone online** and as such, this sort of behaviour can be traced by law enforcement organisations and result in a criminal record.



Layout, Colour Paradigms and Character Sets

Layout

When web developers design websites, it is important that they consider [who will be viewing the website](#) and ensure the website is designed to accommodate for all of these people. The [Equality Act](#) introduced in 2010 makes it [illegal to discriminate against providing a service to a certain group of people](#), which makes this even more important.

Websites must be laid out in a way that makes it [easy for users to navigate between pages](#). Menus are a common tool used to provide function and in English-speaking countries, menus are displayed on the left-hand side of the page. In countries such as Egypt or the UAE, where Arabic is the primary language, these menus may instead be displayed on the right-hand side of the page as Arabic is read from right to left. These sort of [design considerations](#) must be made by developers in order to make websites [accessible to all people](#). This is particularly important for online stores, as a well laid-out website which is easy-to-navigate will [attract more customers](#).

Websites must also be designed in a way that makes them accessible to people with [visual impairments](#) or other disabilities. Some people may need to [enlarge text or alter the contrast](#) in order to view the contents of the website comfortably and a good website will cater for this. Websites should provide [alternative text](#) (alt text) for images and provide a [screen magnifier option](#) so people with visual impairments are not disadvantaged. [Transcripts](#) of audio files should be provided for those with hearing impairments.

Colour Paradigms

When choosing a colour scheme for a website, web developers must take into account [how different colours are interpreted](#) around the world. Some colours are regarded as unlucky in certain cultures and have other negative connotations. For example, while white is associated with mourning in the Middle East, it is associated with purity in Western cultures. Typically, a neutral colour scheme with widely positive connotations will be chosen, such as green which represents luck and nature.

Character Sets

In order to make websites accessible to as wide an audience as possible, the contents must be [translated into multiple languages](#). Some character sets are too small to accommodate all of the characters of a language. ASCII only uses seven bits and so is unable to represent all of the characters in the Chinese language. Therefore [Unicode is the preferred character set](#) as it is able to represent [over a million characters](#).

Synoptic Link

You will have come across character sets such as ASCII and Unicode in 1.4.1.

